550584

# FLOOD INSURANCE STUDY

## VILLAGE OF BLACK CREEK, WISCONSIN

OUTAGAMIE COUNTY

best copy available

SEPTEMBER 2, 1980

federal emergency management agency
federal insurance administration

COMMUNITY NUMBER - 550584

FEMA 209.

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### EXHIBITS


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Black Creek Panel 01P

Exhibit 2 - Flood Boundary and Floodway Map


PUBLISHED SEPARATELY:

Flood Insurance Rate Map

FLOOD INSURANCE STUDY

VILLAGE OF BLACK CREEK,
OUTAGAMIE COUNTY, WISCONSIN

# 1.0 INTRODUCTION

## 1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Village of Black Creek, Outagamie County, Wisconsin, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert the Village of Black Creek to the regular program of flood insurance by the Federal Insurance Administration (FIA). Local and regional planners will use this study in their efforts to promote sound flood plain management.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these Federally-supported studies are based. These criteria take precedence over the minimum Federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 44 CFR, 60.1 (d). In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

## 1.2 Authority and Acknowledgements

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by Carl C. Crane, Inc., for the Federal Insurance Administration, under Contract No. H-4785. This study was completed in August 1979.

## 1.3 Coordination

Streams requiring detailed study were identified at a meeting attended by representatives of the Study Contractor, the FIA, the Wisconsin Department of Natural Resources, and the Village of Black Creek on April 20, 1978. Results of the hydrologic analyses were coordinated with the Wisconsin Department of Natural Resources, Flood Plain Management Section.

On March 20, 1980, the results of the work by the Study Contractor were reviewed and accepted at a final coordination meeting attended by representatives of the Study Contractor and the FIA, and community officials.

## 2.0 AREA STUDIED

### 2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Village of Black Creek. The area of study is shown on the Vicinity Map (Figure 1).

The areas studied by detailed methods were selected with priority given to all known flood hazard areas, and areas of projected development or proposed construction for the next five years, through August 1984. The scope and methods of study were proposed to and agreed upon by the FIA and the Village of Black Creek.

Floods caused by overflow of the Black Creek from the downstream limit to the upstream limit of flooding affecting the community were studied in detail.

### 2.2 Community Description

The Village of Black Creek is located in Outagamie County which lies in the east-central region of Wisconsin. Bordered on all sides by the unincorporated areas of Outagamie County, the total land area contained within the city limits is approximately 1.0 square mile. Black Creek was incorporated in 1904. In 1970 its population was listed as 921, as obtained from the 1973 State of Wisconsin Blue Book (Reference 1).

The climate in east-central Wisconsin is characterized by wide variations in temperatures. Average summer and winter temperatures for the years 1969 to 1973 ranged from 72 degrees Fahrenheit (F.) to 11 degrees F., respectively. Average annual precipitation of the region is 26.5 inches with an average recorded snowfall of 45 inches. Precipitation is normally higher in the spring and summer months (References 1 and 2).

The geological formations are the Upper Cambrian (Potsdam) sandstone, the Lower Magnesian limestone, the St. Peter sandstone, and the Galena-Platteville (Trenton) limestone. These indurated rock formations are quite generally covered with glacial drift on the divides, alluvial sand and gravel, and glacial drift in the valleys (Reference 3). The surface of Outagamie County is quite gently sloping and without prominent relief. The Fox River flows northward across the southeastern part and the Wolf River flows southward across the northwestern part. The divide between these rivers, forming the highest land in the county, extends northeast-southwest diagonally across the central part of the county. The lowland along the Fox River and the Wolf River is a little above 750 feet, hence the maximum range in elevation is between 100 and 150 feet. A belt of undulating drift hills extends northward along the divide, through the vicinity of Greenville and Black Creek. The land in the flood plain is typically open space. Because of low land conditions, it is not agriculturally or commercially used.

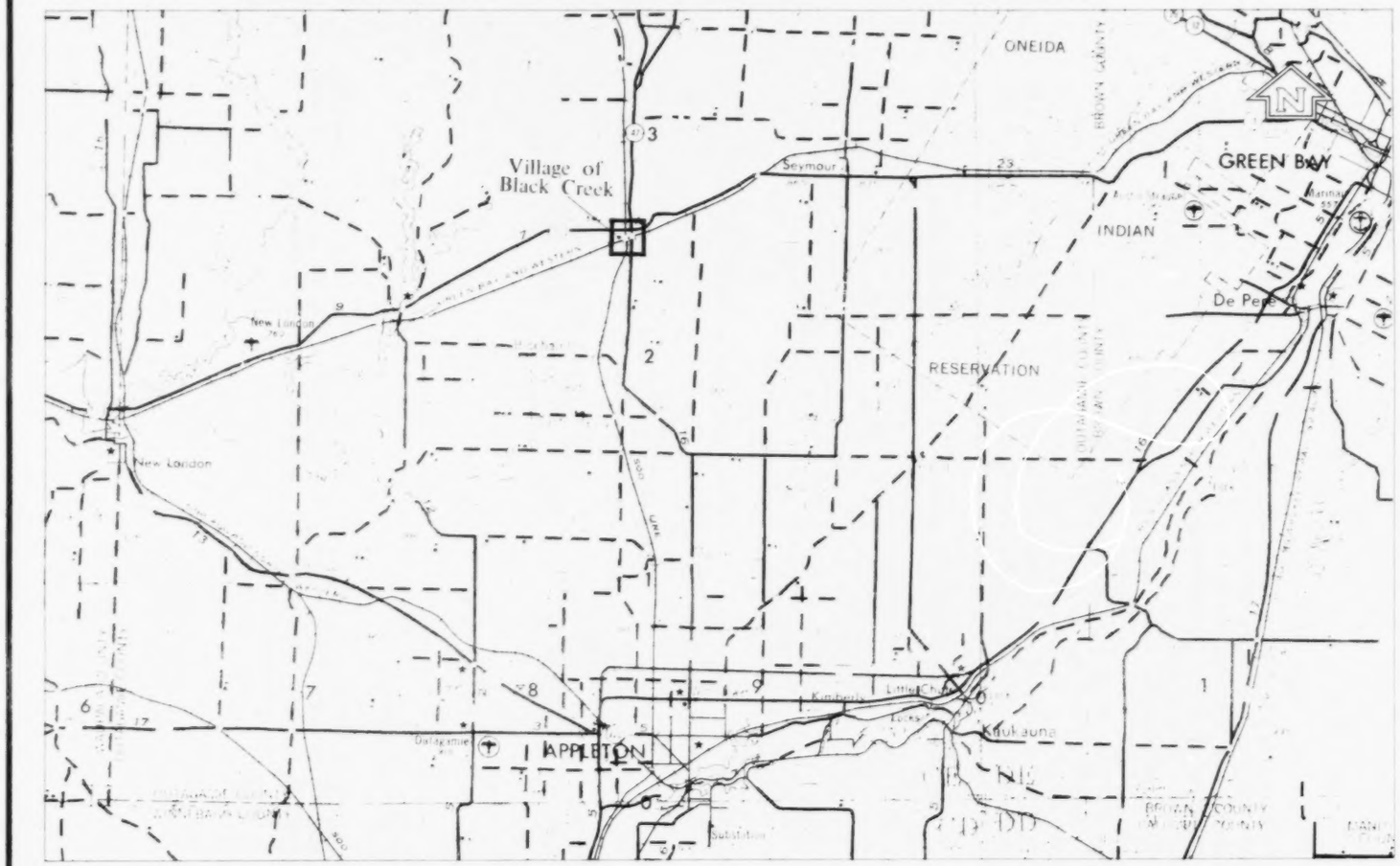


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

# VILLAGE OF BLACK CREEK, WI
(OUTAGAMIE CO.)

APPROXIMATE SCALE
4 0 4 8 12 MILES

## VICINITY MAP

## 3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for the flooding source studied in detail affecting the community.

For the detailed analysis of Black Creek, the hydrology was investigated by using the procedures outlined in the Soil Conservation Service (SCS) National Engineering Handbook (Reference 4). Using this procedure, the time of concentration and time of peak were computed for the basin. A unit hydrograph was then developed using the "pattern" hydrograph developed by the SCS. The expected 6-hour rainfall for the desired frequency event was obtained from Technical Paper 40 (Reference 2) and distributed into 30-minute amounts as described in the SCS criteria for design storms. A 6-hour duration was chosen since it was determined to be the "effective duration" for areas having an annual precipitation of approximately 30 inches. Rainfall excess was computed from accumulated rainfall, using an SCS runoff equation which equates runoff as a function of soil type, land use, and antecedant moisture conditions. Utilizing these precipitation data and the derived unit hydrograph, an outflow hydrograph was computed.

The drainage basin immediately upstream of the Village of Black Creek is extremely flat and marshy. A controlled outlet is produced by the Soo Line Railroad bridge and the bridge at State Highway 47. In an effort to evaluate the storage capacity of this marshy area, a TR-20 basin model was established (Reference 5) and a Modified Puls Routing scheme was developed. A substantial attenuation and subsequent reduction of peak discharges occur as a result of this flat area. Peak discharges contained in this report reflect the effects of the storage area.

Peak discharges for the 10-, 50-, 100-, and 500-year floods of the flooding source studied in detail in the community are shown in Table 1.

TABLE 1 - SUMMARY OF DISCHARGES

| FLOODING SOURCE AND LOCATION | DRAINAGE AREA (SQ MILES) | PEAK DISCHARGE (CFS) 10-YEAR | 50-YEAR | 100-YEAR | 500-YEAR |
|---|---|---|---|---|---|
| BLACK CREEK | | | | | |
| State Route 47 | 55.9 | 410 | 425 | 440 | 460 |

## 3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the streams in the community were carried out to provide estimates of the elevations of the floods of the selected recurrence intervals along the flooding source studied in detail.

FIGURE 2 - Photo of Black Creek taken from the Soo Line Railroad bridge, looking in an easterly direction during the April 1979 flood.

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Cross sections and bridge elevation data and structural geometry for the backwater analyses of the flooding sources studied were obtained by field surveys by the Study Contractor. The channel soundings were also obtained by field measurement.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 2).

Channel roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and based on field observations of the streams and flood plain areas. The roughness value used for the main channel of the Black Creek was 0.045, and the flood plain roughness value was 0.065 for all recurrence intervals.

The 100-year starting water-surface elevation used for the Black Creek was the 10-year water-surface elevation for the Wolf River, adjusted to this location (Reference 6). The 10-year starting water-surface elevation on the Black Creek was the normal elevation on the Wolf River. The 50- and 500-year starting elevations were determined in similar manners. Water-surface elevations of floods of the selected recurrence intervals were computed through use of the U.S. Army Corps of Engineers (COE) HEC-2 step-backwater computer program (Reference 7). Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals (Exhibit 1). The profiles included in this report reflect the backwater of the Wolf River to approximately 300 feet downstream of the Soo Line Railroad bridge.

The hydraulic analyses for this study are based only on the effects of unobstructed flow. The flood elevations as shown on the profiles are, therefore, considered valid only if hydraulic structures, in general, remain unobstructed and if channel and overbank conditions remain essentially the same as ascertained during this study.

All elevations are referenced from National Geodetic Vertical Datum of 1929 (NGVD); elevation reference marks used in the study are shown on the maps.

## 4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

### 4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the FIA as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the boundaries of the 100-year and the 500-year floods

have been delineated using the elevations determined at each cross section; between cross sections the boundaries were interpolated using topographic maps at a scale of 1:24000, with a contour interval of 10 feet (Reference 8).

The boundaries of the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map (Exhibit 2). Small areas within the flood boundaries may lie above the flood elevations and, therefore, not be subject to flooding; owing to lack of detailed topographical information or to limitations of the map scale, such areas are not shown. In cases where the 100-year and the 500-year flood boundaries are close together, only the 100-year boundary has been shown.

## 4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood may be carried without substantial increases in flood heights. Minimum standards of the FIA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. However, the Wisconsin Department of Natural Resources has established a policy that limits encroachment in the flood plain to 0.1 foot (Reference 9).

The floodways in this study were developed to reflect the existing effective flow limits using the HEC-2 program with a zero surcharge (Reference 7). The results of these computations were tabulated at selected cross sections for each stream segment for which a floodway was computed (Table 2). Portions of the floodway for the Black Creek are beyond the corporate limits.

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway boundaries were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the boundaries of the floodway and the 100-year flood are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 0.1 foot at any point. Typical relationships between the floodway and the

| FLOODING SOURCE | | FLOODWAY | | | BASE FLOOD WATER SURFACE ELEVATION | | | |
|---|---|---|---|---|---|---|---|---|
| CROSS SECTION | DISTANCE[1] | WIDTH[2] (FEET) | SECTION AREA (SQ. FEET) | MEAN VELOCITY (FEET/SEC.) | REGULATORY (NGVD) | WITHOUT FLOODWAY (NGVD) | WITH FLOODWAY (NGVD) | INCREASE (FEET) |
| BLACK CREEK | | | | | | | | |
| A | 3.31 | 494 | 1120 | 0.39 | 768.5 | 767.3[3] | 767.3 | 0.0 |
| B | 3.48 | 190 | 464 | 0.95 | 768.5 | 767.4[3] | 767.4 | 0.0 |
| C | 3.60 | 42 | 138 | 3.19 | 769.6 | 769.6 | 769.6 | 0.0 |
| D | 3.69 | 434 | 664 | 0.66 | 770.1 | 770.1 | 770.1 | 0.0 |
| E | 3.76 | 128 | 343 | 1.28 | 770.2 | 770.2 | 770.2 | 0.0 |

[1] MILES ABOVE MOUTH
[2] THIS WIDTH IS BEYOND CORPORATE LIMITS
[3] ELEVATIONS WITHOUT CONSIDERING BACKWATER EFFECT FROM WOLF RIVER

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

VILLAGE OF BLACK CREEK, WI
(OUTAGAMIE CO.)

FLOODWAY DATA

BLACK CREEK

floodway fringe and their significance to flood plain development are shown in Figure 3.

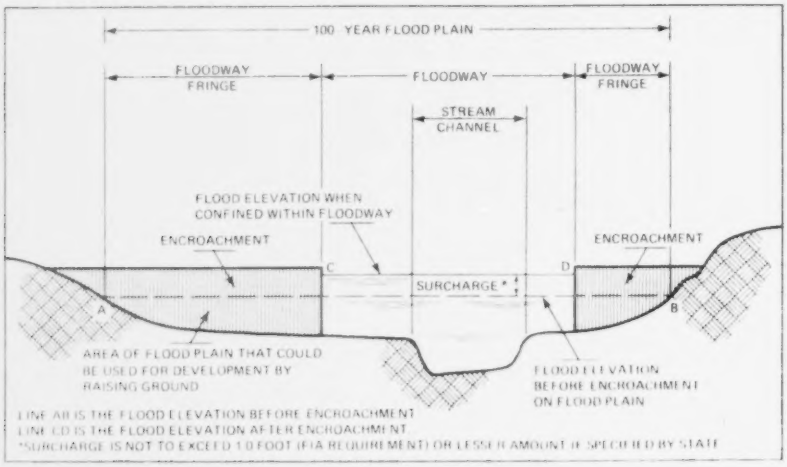

100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE AB IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE CD IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE IS NOT TO EXCEED 1.0 FOOT (FIA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE

FIGURE 3 - Floodway Schematic

The floodways in this report are recommended to local agencies as minimum standards that can be adopted or that can be used as a basis for additional studies.

## 5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the FIA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHF), and flood insurance zone designations for each flooding source affecting the Village of Black Creek.

### 5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach.

| Average Difference Between 10- and 100-year Floods | Variation |
|---|---|
| Less than 2 feet | 0.5 foot |
| 2 to 7 feet | 1.0 foot |
| 7.1 to 12 feet | 2.0 feet |
| More than 12 feet | 3.0 feet |

The locations of the reaches determined for the Village of Black Creek are shown on the Flood Profiles (Exhibit 1) and are summarized in the Flood Insurance Zone Data Table (Table 3).

## 5.2 Flood Hazard Factors

The FHF is used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their FHFs are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest 0.5 foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year water-surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

## 5.3 Flood Insurance Zones

After the determination of reaches and their respective FHFs, the entire incorporated area of the Village of Black Creek was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

| | |
|---|---|
| Zones A1, A3: | Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations are shown, and zones subdivided according to FHF. |
| Zone B: | Areas between the Special Flood Hazard Area and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; or areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided. |
| Zone C: | Areas of minimal flooding. |

Table 3, "Flood Insurance Zone Data," summarizes the flood elevation differences, FHFs, flood insurance zones, and base flood elevations for the flooding source studied in detail in the community.

| FLOODING SOURCE | PANEL[1] | ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND | | | FLOOD HAZARD FACTOR | ZONE | BASE FLOOD ELEVATION[3] (NGVD) |
|---|---|---|---|---|---|---|---|
| | | 10% (10-YEAR) | 2% (50-YEAR) | 0.2% (500-YEAR) | | | |
| BLACK CREEK | | | | | | | |
| BACKWATER REACH[4] | 0001 | –1.3 | –0.4 | 0.5 | 015 | A3 | 769 |
| REACH 1 | 0001 | –0.2 | –0.1 | 0.1 | 005 | A1 | VARIES–SEE MAP |

[1] FLOOD INSURANCE RATE MAP PANEL
[2] WEIGHTED AVERAGE
[3] ROUNDED TO NEAREST FOOT
[4] DATA FOR THIS REACH TAKEN FROM OUTAGAMIE COUNTY, WISCONSIN FIS

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

**VILLAGE OF BLACK CREEK, WI**
**(OUTAGAMIE CO.)**

**FLOOD INSURANCE ZONE DATA**

**BLACK CREEK**

### 5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the Village of Black Creek is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the FIA.

## 6.0 OTHER STUDIES

A Flood Insurance Study for the unincorporated areas of Outagamie County agrees with this study (Reference 6). No other studies were found to exist at the time of this report.

A Flood Hazard Boundary Map has been published by the Federal Insurance Administration (Reference 10). The differences between the Flood Hazard Boundary Map and this study are justified due to the more detailed nature of this Flood Insurance Study.

This report either supersedes or is compatible with all previous studies published on streams studied in this report and should be considered authoritative for the purposes of the National Flood Insurance Program.

## 7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic and other pertinent data used in this study can be obtained by contacting the Insurance and Mitigation Division, Federal Emergency Management Agency, One North Dearborn Street, Chicago, Illinois 60602.

## 8.0 REFERENCES AND BIBLIOGRAPHY


1. Wisconsin Legislative Reference Bureau, The State of Wisconsin 1973 Blue Book, 1973.

2. U.S. Department of Commerce, Technical Paper No. 40, Rainfall Frequency Atlas of the United States, January 1963.

3. Weidman, Samuel, and Alfred Schultz, The Underground and Surface Water Supplies of Wisconsin, State of Wisconsin, 1915.

4. U.S. Department of Agriculture, Soil Conservation Service, Section 4, National Engineering Handbook, Hydrology, August 1972.

5. ----------, Control Technical Unit, Technical Release No. 20, Computer Program for Project Formulation: Hydrology, May 1965.

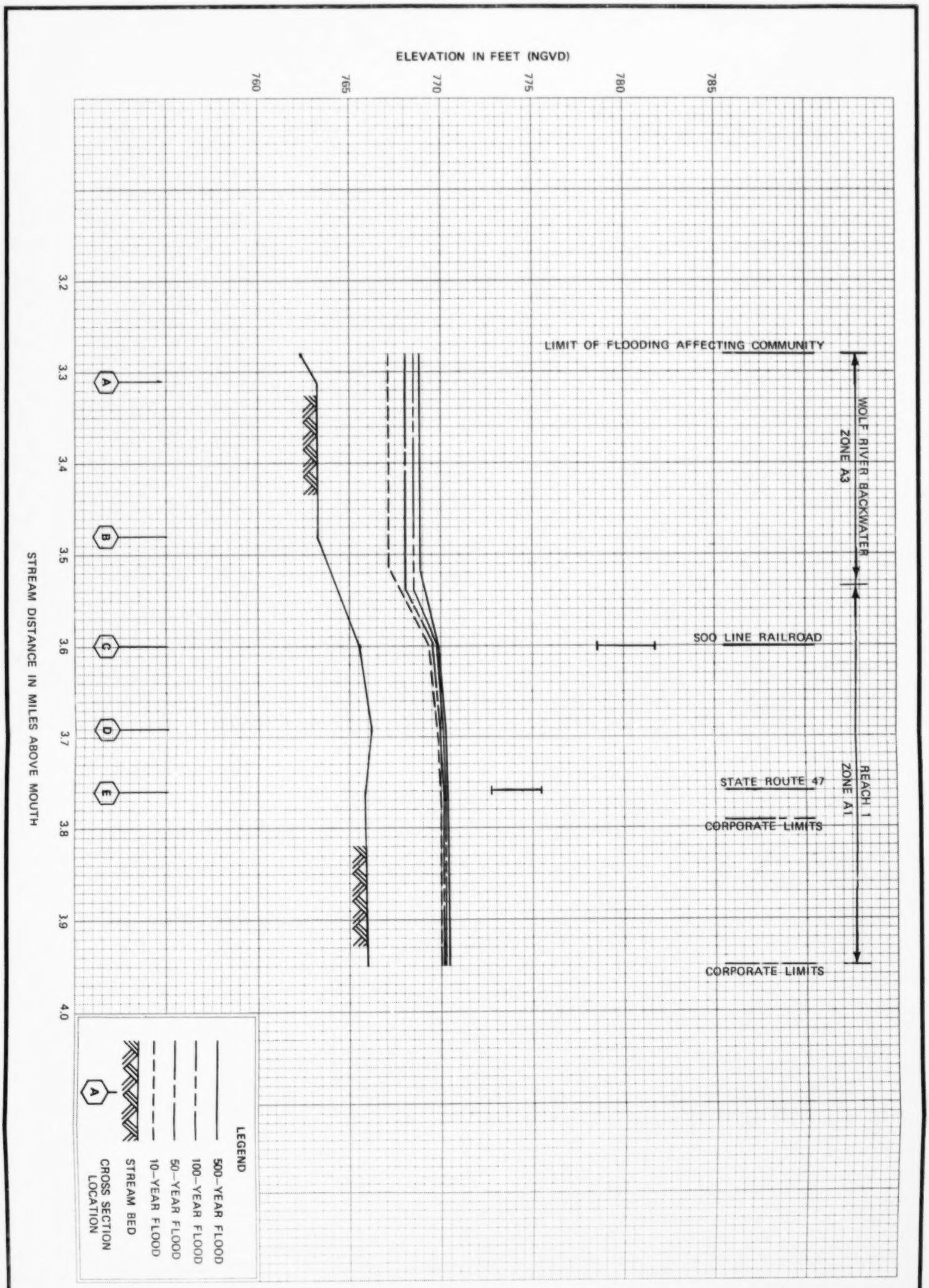
6. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Insurance Study, Unincorporated Areas of Outagamie County, Wisconsin, September 1977.

7. U.S. Army Corps of Engineers, Hydrologic Engineering Center, Computer Program 723-X6-L202A HEC-2 Water-Surface Profiles, Davis, California, November 1976 with updates.

8. U.S. Geological Survey, 7.5 Minute Series Quadrangle Map, Scale 1:24000, Contour Interval 10 feet: Black Creek, Wisconsin, 1974.

9. Wisconsin Department of Natural Resources, Wisconsin's Flood Plain Management Program, Chapter NR 116, Register No. 259, 1977.

10. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, Village of Black Creek, Wisconsin, November 1975.




FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration
VILLAGE OF BLACK CREEK, WI
(OUTAGAMIE CO.)

FLOOD PROFILES

BLACK CREEK

01P